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Aqueous processing of organic compounds in carbonaceous asteroids

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There is growing evidence pointing towards a prebiotic synthesis of complex organic species in water-rich undifferentiated bodies. For instance, clays have been found to be associated with complex organic compounds (Pearson et al. 2002; Garvie & Buseck 2007; Arteaga et al. 2010), whereas theoretical calculations have studied the interaction between the organic species and surface minerals (Rimola et al., 2013) as well as surface-induced reactions (Rimola at al. 2007). Now, we are using more detailed analytical techniques to study the possible processing of organic molecules associated with the mild aqueous alteration in CR, CM and CI chondrites. To learn more about these processes we are studying carbonaceous chondrites at Ultra High-Resolution Transmission Electron Microscopy (UHR-TEM). We are particularly interested in the relationship between organics and clay minerals in carbonaceous chondrites (CCs) matrixes (Trigo-Rodríguez et al. 2014, 2015).We want to address two goals: i) identifying the chemical steps in which the organic molecules could have increased their complexity (i.e., surface interaction and catalysis); and ii) studying if the organic matter present in CCs experienced significant processing concomitant to the formation of clays and other minerals at the time in which these planetary bodies experienced aqueous alteration. Here, these two points are preliminarily explored combing experimental results with theoretical calculations based on accurate quantum mechanical methods.

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